

GOD CITY INSTRUMENTS – Gradient V1.1 Build guide

The God City Instruments (GCI) Gradient is a unusual circuit which allows for two distinctly different characters of boost simply by turning the COLOR knob left or right. The tone is fairly neutral when the pot is centered. With careful selection of components, the two tonal characters can be either a mid, bass, or treble boost. While this is intended as a mod to be installed in other dirt pedals, there are alternate pads provided for a gain pot and clipping diodes if you choose to wire it as a stand-alone overdrive.

Gain in this circuit is determined roughly by the ratio between negative feedback resistance (R9) and the shunt to ground (COLOR pot plus R10 and/or R8 plus the resistance of L (approximately 80 ohms.)) Imagine the pot as 2 resistors with the wiper as the junction between the two. At the extreme ends of the pot's throw, the opposite side's contribution to total resistance is negligible. So, if built stock, when the COLOR pot is fully CW, gain is approximately $47k/220R$. When fully CCW, gain is approximately $47k/(220R + 80R)$.

The shunt path containing C3, L, and R10 forms a band pass filter centered at 876hz. This is a nice frequency for boosting electric bass or guitar. To adjust this frequency, try different values for C3. Bigger values for lower frequency. An excellent resource for calculating band pass frequencies can be found here:

<http://sim.okawa-denshi.jp/en/RLCtool.php>

The shunt path containing R8 and C5 forms a high pass filter with a roll off corner frequency of 153hz. While this is technically a high pass filter, overdrives typically high pass at 600-800hz so you may perceive this as a bass boost. To build increase high pass filtering, reduce C5 to as low as 0.47uF. 1uF would provide a typical overdrive sound. And excellent resource for calculating high pass frequencies can be found here:

<http://sim.okawa-denshi.jp/en/CRtool.php>

GAIN pot, D2, and C7 are not intended to be populated unless you build this as a stand-alone overdrive pedal. D2 provides pads to add clipping diodes of your choice. C7 provides a place for a negative feedback cap to smooth diode clipping if necessary. GAIN provides a place to add a gain pot. Do not populate R9 if using a gain pot.

Minimum enclosure size for building this as stand-alone is 1590B. COLOR pot is intended to float off the side of the board, but can be flipped to sit under the board if space requires it. It will make the pot operate backwards, but that is inconsequential for this circuit.

This pedal is an easy build, but this guide is intended for people who have some experience building pedals. Component sourcing, component identification, assembly techniques, wiring stomp switches, etc. is not covered. The GCI Brutalist Jr. assembly guide has helpful information for less experienced builders. That guide can be found here:

<http://www.kurtballou.com/brutalistjr/>

Available separately is the GCI 3PDT utility PCB for PCB pin 3PDT footswitches. This PCB makes footswitch wiring quick and easy. Not compatible with solder lug style switches.

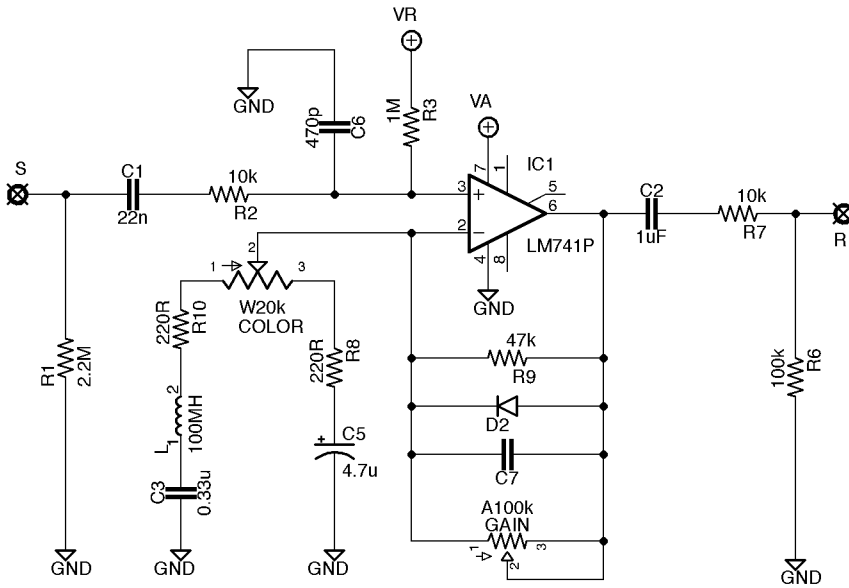
Don't forget to connect the ground pad of the PCB to the ground lug of the input, output, and DC power jacks!

Due to the scope of this project, technical support is not available. However, consider joining the GCI DIY PCB Builders group on Facebook to get advice from and share your work with other builders. We require that all group members agree to the rules before being accepted into the group.

<https://www.facebook.com/groups/2454786551255317/>

Component values for the PCB as well as some alternate values are listed below. This is a BOM for the PCB only. Resistors and diodes are 6.3mm leg spacing, film and ceramic capacitors are 5.08mm leg spacing, and electrolytic capacitors are 2.54mm leg spacing. I/O jacks, DC jack, switch, enclosure, and knobs are not listed. The schematic is also attached.

Part	Value	Description	Substitute	Substitution Notes
C1	22n	Film Cap	10n-100n	Input cap. Forms high pass filter with R3
C2	1uF	Film Cap		
C3	0.33u	Film Cap		
C4	47u	Electrolytic Cap	100u	Power filter cap
C5	4.7u	Electrolytic Cap	470n-10u	Forms high pass filter with R8
C6	470p	Ceramic Cap	220p-2.2n	Forms input low pass filter with R2
C7	TBD	Ceramic Cap	47p-1n	Only needed if using clipping diodes. 470p is a typical value
C8	100u	Electrolytic Cap	47u-220u	Power filter cap
CLR	4.7k	1/4 Watt Resistor	2.2k-10k	Currently limiting resistor for LED
R1	2.2M	1/4 Watt Resistor		
R2	10k	1/4 Watt Resistor	1k-33k	
R3	1M	1/4 Watt Resistor		
R4	10k	1/4 Watt Resistor		
R5	10k	1/4 Watt Resistor		
R6	100k	1/4 Watt Resistor		
R7	10k	1/4 Watt Resistor		
R8	220R	1/4 Watt Resistor	100R-470R	Influences gain and forms high pass with C5
R9	47k	1/4 Watt Resistor	33k-100k	Sets op amp gain. Do not stuff if using gain pot.
R10	220R	1/4 Watt Resistor	100R-470R	Influences gain and forms band pass with C3 and L
D1	1n5818	Schottky Diode	1n4001, 1n5817	Any suitable polarity protection diode
D2	TBD	TBD	1n4148, 1n456a, 1n34a, etc	Any network of preferred soft clipping diodes. Do not stuff unless using gain pot.
LED	L1	3mm LED		
L	100MH	Abracon AISR-01-104J	Bournes, Murata	Inductors with DCR less than 100 ohms will produce a more noticeable effect
IC1	LM741P	OP AMP	TL071, OP07, NE5534	Any pin compatible single op amp
COLOR	W20k	16mm Pot	B25k	Works in a pinch, but taper will feel weird
GAIN	TBD	16mm Pot	A100k-A250k	Gain pot. Do not stuff if using R9.
S	PAD	Send to PCB		
L+	PAD	LED +		
L-	PAD	LED -		
R	PAD	Return from PCB		
V	PAD	9v Input		
G	PAD	Ground		



Do not populate both R9 and GAIN pot.
 See build guide.

